

Cost of Teaching Typewriting Can Be Greatly Reduced

Experiments with a simplified keyboard indicate, according to the authors, that typewriting can be taught in half the time now required, thus making present facilities adequate for many more pupils

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THE training of typists is a huge educational undertaking even in terms of the million employed typists in American business and industry. Typewriting classes in schools, however, are destined to a far greater expansion as personal use of private portable and standard machines forges ahead of the obviously saturated office field. Once considered only a tool of commerce, the typewriter is today an important tool for practically all whose educational and vocational level corresponds to that of the usual high school junior or senior.

Teaching Costs Can Be Cut 50 Per Cent

This is a period when people are given to much communication and literary expression. Yet the cost of necessary desks and adjustable chairs, typewriters, materials, often special rooms, the time required and the specialized teachers, make typewriting one of the more expensive subjects in the high school curriculum. The annual cost of high school typewriting classes is about \$560,000 in the state of Washington alone. For the entire country the cost runs into millions of dollars. Despite this great outlay, most school typing instruction is extremely inefficient. Its high cost can be reduced more than 50 per cent along with marked rises in the efficiency of pupil typists. This should interest school men.

The persistence of handwriting classes in the school curriculum after the general acceptance of modern precision typewriters in all sections of the United States is perhaps one of the curious social lags in our technical civilization. There are, however, certain factors of this lag which only now appear under control. The problem of this control is allied to those outstanding applications of psychology to industrial shops known as motion and time study. The story of machine writing can be traced in increases of savings in both time and motion.

Writing machines were launched with a patent under Queen Anne in 1714, and to write with them proved a slower process than writing with the ubiquitous pen. Over a century later, in 1873, under the inventive hands of Christopher Latham Sholes, a practical machine, writing capital letters, was shaped in his modest shop in Milwaukee. Despite upwardly striking type bars that left the writing "blind," or hidden; despite crude "sewing machine" lines and a foot treadle for returning the carriage, this typewriter became a commercial success in 1886. Mark Twain then called it a "curiosity breeding little joker." Its chief resemblance to the modern typewriter was its keyboard by which the writing was controlled. This curious keyboard was patched together in Sholes' heart-breaking experiments to fit keys into positions without colliding or sticking at the writing point. Although such mechanical difficulties have long since disappeared from the modern typewriter, this patchwork keyboard has scarcely changed. Unfortunately, such a keyboard is not related, except by chance, to the sequences of written English or even to the arrangement of letters in a printer's case.

Timesaving Demonstrated in Experiments

Despite the survival of a haphazard keyboard, typing as a timesaver has become more and more popular. Numerous mechanical improvements have brought forth the modern, front-strike, precision machine with its visible writing. Such advances have culminated in the improved portable typewriter and in the pressure printing of the noiseless machine, with its fast, light, staccato touch. It is true that schools are still prone to use typewriters with a heavy and uneven key resistance. It is true that laboratory tests show the average typewriter mechanically at about three-fifths of its possible efficiency, and that individual machines differ widely and uncomfortably as long

as the schools fail to insist upon a uniform factory adjustment. All these handicaps, however, are needless today. With the opening of the present century, the all-finger touch method of typing with the eyes on the copy first won general acceptance. Increased efficiency of typing teachers has made feasible a shortening of the usual two-year course by one full semester. Timesaving is well demonstrated in the University of Iowa experiments, where fully a third of the first semester time is eliminated by practice upon most common words and use of a steady, rhythmic pace from dictating machines. Timesaving is likewise shown in surprising speed increases when a newly developed flexible, electric timing mechanism sets the stroking rhythm for the class.

The sharing of portable typewriters, during the experiment by Wood and Freeman, among 6,000 children in kindergartens and the first six grades, has added pleasurable incentives to elementary teaching.¹ With ninety to 130 informal typing minutes each week, young children typewrite with the speed of handwriting. This is sheer gain since their handwriting keeps its usual form. With typewriters it seems easier for children to think, to turn out more written work and to do more original writing. The difficulties that handicap these typing interests of young children, says Haefner,²

¹Wood, Ben D. and Freeman, Frank, *An Experimental Study of the Educational Influences of the Typewriter in the Elementary School Classroom*, The Macmillan Company, New York City, 1932.

²Haefner, Ralph, *The Typewriter in the Primary and Intermediate Grades*, The Macmillan Company, New York City, 1932.

center in the actual manipulation of the keyboard. Their systematic use of this new medium thus depends upon a simpler keyboard.

With these advances into earlier and faster learning of fast touch typing has come what Wood and Freeman describe as a large social movement—the personal use of the typewriter as a substitute for the laborious pen or pencil. Personal typing opens a new and large field of school training. To the earlier appeal of the ease with which typing can be read has been added the appeal of far faster writing. The typewriter is now the medium for fast fluent expression of thoughts and even of written pleasantries. The typewriter is today's accepted writing tool for the personal use of the vast number of people capable and desirous of using it in their social life. This new mode should raise the tone of the volume of written output in schools and colleges. Noiseless portable typewriters in study rooms and school libraries should quicken the pace of reference work. As a part of social living the typewriter seems ready to enter into everyday school and home usage by most high school and many junior high school pupils.

The immediate problem that confronted our experiments at the University of Washington is now reduced to advancing the trend toward timesaving until the training period becomes so short that it ceases to be a burden either for the majority of pupil typists or for the school administration. Conventional typing classes do not arouse interest or

COMPARISON OF ATTAINMENTS OF PUPILS TAUGHT TO TYPEWRITE ON MACHINES EQUIPPED WITH THE SIMPLIFIED KEYBOARD WITH ATTAINMENTS OF PUPILS TAUGHT ON THE UNIVERSAL KEYBOARD

Dvorak-Dealey Simplified Keyboard		
Classification	Ave. No. of Fifty-Minute Instruction Periods	Gain in Net Words a Minute per Instruction Per.
9 High school pupils	36	1.11
12 High school pupils	38	1.13
44 University and adult students	26	1.23
39 Junior high school pupils	24	0.8
8 Adult students with previous typing experience	29	2.00
104 Beginning pupils	27.5	1.06

Universal Keyboard

Universal Keyboard		
Classification	Number of Instruction Periods	Gain in Net Words a Minute per Instruction Period
Usual H. S. requirement for credit	90	0.20
Average H. S. attainment	90	0.28
Usual H. S. requirement for credit	180	0.17
Average H. S. attainment	180	0.20
Superior H. S. attainment	180	0.22
Washington state championship record	180	0.32
Washington state championship record	360	0.20

¹Attainment in net words a minute was measured in accordance with the International Typewriter Contest rules.



Pupils participating in the typewriting experiments conducted at the University of Washington.

lead to success because of the amount of time and effort required to attain reasonable accuracy and speed. A successful minimum of time and motion we place at fifty net words a minute within a single semester of training.

At the outset we were puzzled by typing errors that no one seemed able to explain. Among the best high school typists in the Washington competition, for example, 163 made a total of 1,000 errors within fifteen minutes on the 1,000 most common English words.¹ Nearly one-half of these errors were in the fifty most common words, usually spelled correctly by first and second graders. The accuracy gain after a second year of training was only two words a minute, while errors on the fifty most common words actually rose. We were forced to search for some basic interference underlying all pupil typing, and we found this in the patchwork keyboard. To listen to a good typist is to hear either breaks or a slowing in his rhythmic pace. If this typist is writing eighty words a minute with both hands stroking alternately, for example, with words such as "sad," "sadder," "saddest," "greatest," "minimum," typed entirely in one hand, this hand must either approximate 160 words a minute or drop the total speed to about forty words. Frequent idling of an entire hand while the other does double duty is a striking

aspect of the 47 per cent overload thrown upon the left hand, apart even from its repeated carriage throws. Here is a left-handed keyboard in a right-handed world. Similar overloads of weaker fingers while stronger fingers loaf add difficulties and condemn further the so-called universal keyboard.

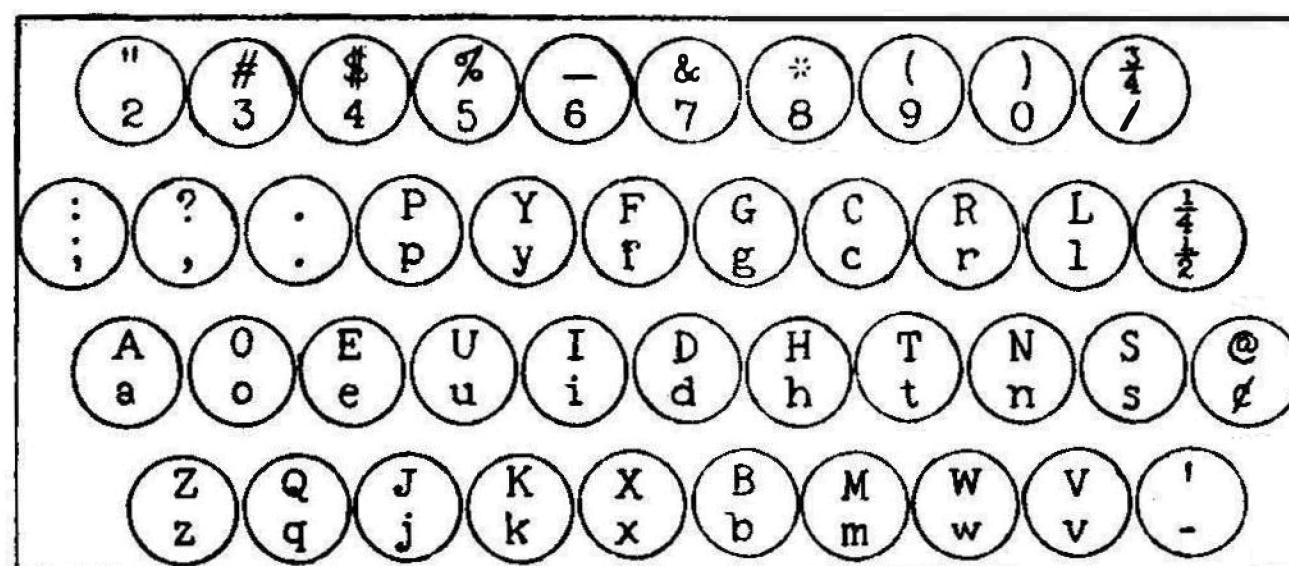
Yet the real situation soon seemed to us far more serious. We found that a fourth of all the usual typewriting is needlessly forced into more or less awkward stroking of the keyboard. For over 4 per cent of ordinary typing the same finger slowly taps two keys in succession. Fully a sixth of the usual two-letter combinations or digraphs reach across the barrier of what is alleged to be a "home" row above which the typist's fingers hover in the central home position. This large amount of wasteful finger hurdling is due to the chance fact that the early, original keyboard left most common English sequences out of the home row. Once out of the home row, these most common English sequences tended to fall into awkward positions. Indeed, most typewriting motions actually are forced to the upper row of keys and are to this extent wasteful. There is no genuine home row in the present keyboard. This is a school fiction told students, while its so-called guide keys often are obstructions for the fingers to hurdle. Slow motion pictures visualize in dramatic fashion this absence of an actual home row, this repeated idling of one or the other hand, and this forcing of excessive

¹Dvorak, August, and Ford, Gertrude C., *The Growth of Typewriting Speed and Accuracy*, *The Balance Sheet*, Oct., 1932, p. 66.

motions from fingers, entire hands and forearms.

Hitherto, insight into these destructive facts has been clouded by a widespread fallacy that typewriting, fundamentally, is isolated letter stroking. Glorifying the letter stroke in school typing classes has been a fruitful source for the plateau blues that soon overtake even moderately advanced typing students. Fast typing is inevitably slowed, since its speed and rhythmic pace depend upon the extreme overlapping developed between strokes in sequence.

By applying elaborate counts of some thirty-five million digraphs in running copy and also of longer letter combinations, Dvorak and Dealey found that some 10.5 million digraphs are stroked on the present keyboard by awkward, fatiguing and time-consuming finger reaches or hurdles. By making



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Arrangement of the simplified typewriter keyboard.

a measured fit of stroking sequences to the language sequences, the keys were rearranged. This rearrangement reduces the underlying interference by 85 per cent in the direction of more relaxed, rapid and accurate typing, learned in less time. On this Dvorak-Dealey simplified keyboard the finger loads now follow exactly the rank of each finger's ability. The work is smoothly balanced between the hands. Faster stroking by fingers of opposite hands has been built up to cover two-thirds of all ordinary typing. Since every syllable must have a vowel, the new keyboard concentrates the vowels in the left hand, together with common punctuation marks and the least used consonants. In the accompanying illustrative diagram of this simplified keyboard, it is evident that no word or syllable can be typed with the right hand alone and only an insignificant number can be typed with the left hand alone. The somewhat awkward interplay between adjacent fingers, the most common source of errors, is reduced tenfold. Slow serial tapping by the same finger is reduced fourfold, and its hurdling, as the worst sequence in typing, is practically ended. The bulk of the less efficient motions sent to the upper and lower banks of keys, is discarded. The placement of 70 per cent of running copy strokes in the home row should result at once in more rapid learning and easier operation. Almost all typed digraphs, or two-letter combina-

tions, now include the home row and 45 per cent never leave these middle keys.

Continuing experiments at the University of Washington demonstrate that this simplified keyboard permits a usual student achievement of fifty net words typed a minute within the desired minimum of one semester or less of training. During the past summer and the current year, experimental typing classes with 112 students showed consistently a general gain of one net word a minute for every practice period. Beginning high school pupils have performed well above the usual high school yearly rate after only forty-five periods of practice. The former slowing into persistent plateaus has disappeared. As outlined in the accompanying table, our student typing appears four times faster than the usual gain of 0.25 net words a minute for every practice period in the conventional high school class limited to the old keyboard.

This added saving in learning time seems supported by test results from typing classes using the simplified keyboard as part of the employment stabilization research in progress at the University of Minnesota. Its use reveals also the eagerness with which the unemployed during the present economic depression seek to improve their personal equipment by adding typing skill. This complete innovation, with its implied substitution of typewriting for handwriting, is now to undergo a further check-up under classroom conditions.

A Possible Annual Saving of \$10,000,000

The further investigation, already aided by a grant of portable typewriters from the Typewriter Educational Research Bureau and by the ample loan of dictating machines, should prove even more conclusively that the changes outlined are sound and economical. The schools should then develop good typists in one high school semester, whereas two or more semesters are used at present. By one added semester of applied typewriting, pupils should in one year reach attainments now requiring two and in some schools three years of typewriting. The cost of teaching typewriting per pupil should be reduced probably to one-half and perhaps to one-third the present cost. If from two to four times as many pupils can be accommodated with the present equipment and teachers, administrative funds will be correspondingly freed.

Even though estimates of economies are purely approximate, it seems not unduly optimistic to estimate a possible annual saving to the country's schools of \$10,000,000 in the cost of typewriting classes. This tremendous saving would make possible at no added cost the widespread extension, long overdue, of personal typing skill to a great many pupils in junior and senior high schools.